

Glossary of Terms

A

Accrete Gravitationally accumulate mass; the process by which planets form.

Aeronomy. The science of the physics of upper atmospheres.

Aerosols. Large molecules or particulates that remain suspended in air over long periods of time.

Albedo. The fraction of incident radiation reflected by a planet or satellite. If the value is integrated over all wavelengths, it is called the bolometric albedo. If the value is integrated over all directions, it is called the Bond albedo. The geometric albedo is the ratio of the brightness at a phase angle of zero degrees (full illumination) compared with a diffuse, perfectly reflecting disk of the same size.

Apparition. The duration of visibility of a planet during any given year.

Apoapsis. The farthest point in an orbit from the body being orbited.

Arrayed antennas. Ground antennas made to work together in order to enhance the telemetry capability.

Astronomical unit (AU). The mean distance from the Sun to Earth – 149,597,870.694 kilometers.

Aureole A luminous area surrounding the Sun or other bright light when seen through a thin atmosphere.

B

Bit error A loss of information that occurs as a result of the change in value (1 to 0, or 0 to 1) of a single bit by some chance effect.

Black hole. An object whose gravitational field is so strong that even light cannot escape from it.

Bow shock A standing shock wave that forms upstream of a planet. The bow shock forms because the planet's magnetic field creates an obstacle to the incoming solar wind flow. The bow shock heats the solar wind and slows it to subsonic speeds so that it can flow around the planet's magnetosphere.

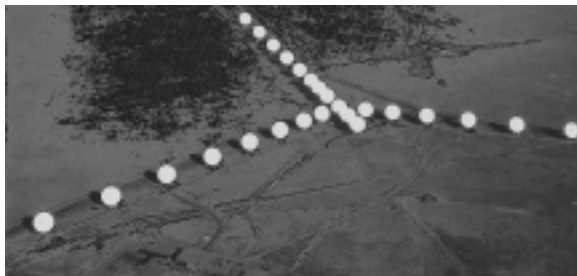
C

Carbonaceous (C-type) material. Carbon silicate primordial material rich in simple organic compounds. C-type material is spectrally flat and exists on the surfaces of several outer planet satellites and C-type asteroids.

Carrier The main component of a radio signal generated by a transmitter.

Central Data Base. A database administered by the Cassini Program that stores relevant project-specific data such as sequence files and ancillary data.

Clathrate. A chemical compound consisting of a lattice molecule and inclusions of a smaller molecule within the crystal lattice; ice or other substance that traps molecules in its crystal structure without chemical bonding.



Very Large Array, Socorro, New Mexico

APPENDIX A

Command. A data transaction which, when issued to a recipient, causes an activity to take place within that recipient's hardware, software or both. A command is defined by a name and input parameters. Commands in a sequence are time-tagged.

Comminuted satellite A satellite (moon) reduced to tiny fragments.

Conjunction. Occurs when the direction from Earth to the spacecraft is the same as that to the Sun.

Convection Transport of energy by means of motion of the material (generally refers to charged particles moving through a magnetic field, gases moving through surrounding atmosphere, or vertical motions of liquids or partially melted solids within a satellite).

Corotating. Moving with the planet's rotation (generally refers to the charged particles in Saturn's magnetosphere that are being carried along by Saturn's magnetic field, which rotates with the planet).

Cosmic rays. Very energetic atomic nuclei, the most energetic of which come from outside of our solar system. Cosmic rays can enter planetary magnetospheres and interact with particles there.

D

DSN pass. An interval of time during which a Deep Space Network (DSN) station is used to communicate with a spacecraft.

D-type material. Primordial, low-albedo, reddish material believed to be rich in organic compounds. It exists on D-type asteroids and on the surfaces of some of Saturn's satellites.

Data block. A segment of data with fixed sizes, organized with a specific structure with a header containing a variety of codes, such as spacecraft identification or source of data.

Data packet A group of data that has been structured into standardized, discrete units for transmission by the spacecraft.

Deceleration Diminishing speed.

Deuterium Heavy hydrogen, so named because the nucleus of a deuterium atom contains a neutron in addition to the proton carried by ordinary hydrogen atoms.

Differentiation Melting and chemical fractionation of a planet or satellite into a core and mantle; the gravitational separation of different kinds of material in different layers in the interior of a planet, generally with denser layers deeper, as a result of heating.



Jean-Dominique Cassini, astronomer

Doppler data Data that determine the speed at which a spacecraft is approaching or departing Earth. The Doppler data are derived from the change of frequency of a downlink signal.

Downlink. On the path from the spacecraft to the ground.

Dynamo theory The theory that attributes planetary magnetic fields to the flow of electric currents in the interior of the planet.

E

Eclipse The passage of a satellite or spacecraft through the shadow of a larger planet or satellite; the Sun is not visible from the smaller body during an eclipse.

Emission. The sending out or giving off of light, infrared radiation, radio waves or matter by a body.

Endogenic Caused by some process originating within a planet or satellite.

Engineering subsystems The spacecraft subsystems that maintain day-to-day functions of the spacecraft and support the science instruments.

Exogenic Caused by exterior processes acting on a planet or satellite.

F

Facility instrument One of the five Cassini Orbiter science instruments (INMS, ISS, RADAR, RSS and VIMS) provided by the Cassini Program for use by a selected team of scientists (as opposed to being provided by the selected team).

G

Galilean satellites The four largest satellites of Jupiter, discovered by and named for Galileo Galilei.



Galileo Galilei, scientist

Gravitational field The region of space surrounding a planet or satellite within which gravitational forces from that planet or satellite can be detected; generally also characterized at each point by a strength and direction.

Gravitational wave Distortion of space and time by a massive object as predicted by Einstein's general theory of relativity.

Gravity The force of attraction between masses in the universe.

Gravity assist Modification of a spacecraft trajectory by passage near a planet; modification of a spacecraft orbit around a planet by passage close to a satellite of that planet.

H

Housekeeping data Data that provide information about the status of a science instrument.

Hydrate A chemical compound with water ice bound to the crystal lattice or adsorbed to the crystal surface.

I

Illumination The lighting up, or the geometry associated with the lighting up, of a surface or atmosphere.

In situ The Latin meaning is "in (its original) place." Spacecraft measurements that sample the local environment make in situ measurements in contrast to cameras, which sense the environment "remotely."

Interdisciplinary Utilizing information from two or more scientific instruments to deduce the nature of some phenomenon.

Ion An atom or molecule electrically charged by the loss or addition of one or more electrons. In planetary atmospheres or magnetospheres, most ions are positively charged, implying that one or more electrons are lost.

Ionosphere The electrically conducting plasma region above the atmosphere of a planet (or Titan) in which many of the atoms are ionized, where charged particles (ions and electrons) are abundant.

Isotope One of two or more forms of an element that differ in atomic mass due to differing numbers of neutrons in the nuclei of its atoms.

APPENDIX A

J

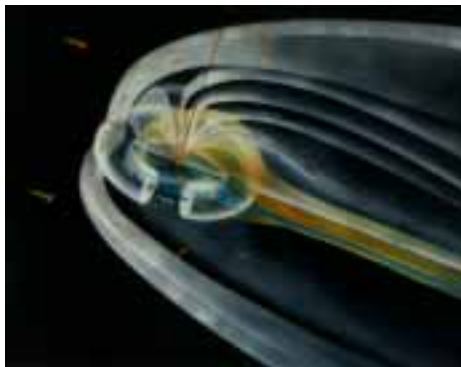
Jovian planet A planet with general characteristics similar to those of Jupiter, also referred to as a “gas giant” planet. The Jovian planets in our solar system are Jupiter, Saturn, Uranus and Neptune.

K

Kelvin A unit of a temperature scale with its zero level at absolute zero temperature (–273.16 degrees Celsius).

Kilometer Preferred distance unit in planetary studies, equal to 1000 meters; about 62 percent of a mile.

Kuiper Belt A belt of small bodies of ice and rock left over from the formation of the solar system. These bodies reside in near-circular orbits beyond Neptune.



Saturn's immense magnetosphere

L

Lag deposit A residual surface deposit remaining after other components of the original surface material have been removed.

Lagrange points Equilibrium points in the orbit of a planet or satellite around its primary. Smaller bodies may reside near these points, which are about 60 degrees ahead of or behind the planet or satellite in its orbit.

M

Mach number The ratio of the speed of the solar wind to the speed of compressional waves. The Mach number of a bow shock is an indication of the bow shock's strength.

Magma Subsurface molten material that may cause volcanic activity on a moon or planet if it breaks through the surface.

Magnetic anomaly A perturbation within an otherwise symmetric dipolar magnetic field. At Saturn, a magnetic anomaly is thought to allow charged particles to precipitate along field lines deep into the magnetosphere and account for Saturn kilometric radiation and auroras.

Magnetic field The region of space surrounding a magnetized planet or satellite in which a moving charge or magnetic pole experiences a force; generally also characterized at each point by a strength and direction.

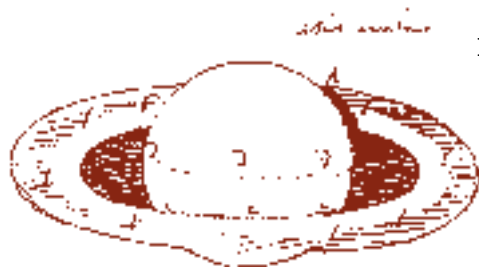
Magnetic reconnection A process whereby magnetic field lines are “cut” and “reconnected” to different field lines, allowing the magnetic topology to change.

Magnetopause The boundary of the magnetosphere that separates the incoming solar wind from the magnetosphere.

Magnetosheath Layer of deflected and shock-heated solar wind plasma between the bow shock and the magnetopause.

Magnetosphere The region around a planet where the planet's magnetic field and associated charged particles (plasma) dominate over the relatively weak interplanetary field carried by the solar wind.

Magnetotail The region of the magnetosphere that stretches away from the Sun (up to several hundred planetary radii) due to the drag of the solar wind flow past the planet's magnetosphere.



Meteorite A piece of celestial debris that hits the surface of planets or satellites; it may range in size from invisible dust to asteroid-sized chunks.

Morphology The external structure of a satellite surface in relation to form or topographic features that may lead to interpretation of the geological history of that surface.

N

Nitrile A compound containing nitrogen.

Noble gas. A nonreactive gas; specifically, helium, neon, argon, krypton, xenon or radon.

Nonresonant orbit An orbit wherein the spacecraft orbital period is not an integer multiple of the satellite's orbital period. Used for orbits that have consecutive flybys with the same satellite at different orbit locations.

Nontargeted flyby A relatively close (less than 100,000 kilometers) flyby that is not tightly controlled but occurs by serendipity during the Saturn tour.

Nucleation The process whereby raindrops condense on a preexisting solid grain of material that is suspended in the atmosphere.

O

Occultation Passage of one object behind another object as viewed by the observer or spacecraft.

Opposition Occurs when the direction from Earth to a spacecraft is the opposite of that to the Sun.

Orbit cranking Changing the orbit of a spacecraft from a gravity-assist flyby without changing its orbital period.

Orbit pumping Changing the orbital period of a spacecraft from a gravity-assist flyby.

Organic molecule A molecule containing carbon; organic molecules are not necessarily associated with life or living organisms.

Orthogonal Descriptive of two or three directions in space that are at right angles (perpendicular) to each other.

P

Packet. The data transmitted by the spacecraft are structured into standardized, discrete data packets to ease their handling and to reduce data noise.

Periapsis The point in an orbit closest to the body being orbited.

Phase angle The angle at the target between the observer (or spacecraft) and the Sun.

Photochemistry Chemical reactions caused or promoted by the action of light (usually ultraviolet light) which excites or dissociates some compounds and leads to the formation of new compounds.

Plasma A completely ionized gas, the so-called fourth state of matter (besides solid, liquid and gas), in which the temperature is too high for atoms as such to exist and which consists of free electrons and free atomic nuclei.

Plasma sheet Plasma of "hot" particles surrounding the neutral sheet in the magnetotail, where the magnetic field reverses from an orientation toward to an orientation away from the planet.

APPENDIX A

Plasma wave. A wave characterized by displacement motions of ions within a plasma.

Polar caps The polar regions in the northern and southern hemispheres in which the magnetic field lines are open to the solar wind. The aurorae form at the boundaries of the polar caps.

Polymers Structures in which the same molecular configuration repeats again and again.

Primary body The celestial body (usually a planet) around which a satellite orbits.

Prograde motion The orbital motion of a planet or satellite that orbits its primary in the same direction as the rotation of the primary.

Q

Quasar Also called quasi-stellar object. An object with a dominant starlike component with spectral lines showing a large redshift.

R

Radiometric dating A method of estimating the age of an object. It entails measuring the fraction of a radioactive material that has decayed and inferring the time elapsed based on laboratory measurements of the decay rate of the radioactive substance.

Ranging data Data that determine the distance between a tracking antenna on Earth and a spacecraft, produced by impressing a ranging code on the radio signal between Earth and the spacecraft.

Reconnaissance Preliminary survey of a planetary system revealing the general characteristics of that system.

Refractivity A measure of the amount of bending experienced by a light beam traveling from one transparent material into another; related to the relative speeds of light in the two materials.

Regolith The broken or pulverized surface layer or rocky debris fragmented by meteorite impacts.

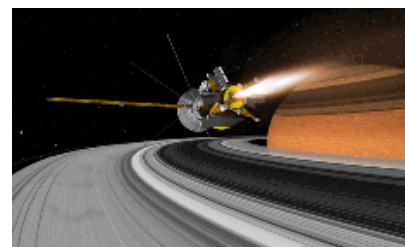
Remote sensing Observations using instrumentation that collects data on an object from a location remote from that object.

Remote site An institution outside the Jet Propulsion Laboratory from which a Principal Investigator or a Team Leader conducts his or her investigation.

Resonance. A pattern of recurring orientations in the orbital positions or rotational states of planets or satellites, leading to repeated gravitational perturbations.

Resonance point. A radial distance within the Saturn ring system where the orbital period of the ring particles is an integer multiple of a relatively nearby satellite's orbital period.

Resonant orbit An orbit in which the spacecraft orbital period is an integer multiple of the satellite's orbital period. Used for orbits that have consecutive flybys with the same satellite at the same orbit location.



Saturn orbit insertion for Cassini

APPENDIX A

Retrograde motion. The orbital motion of a planet or satellite that orbits its primary in a direction opposite that of the rotation of the primary.

Roche limit The distance (equal to about 2.44 times the radius of the primary) within which the tidal forces exerted by the primary on an icy satellite exceed the internal gravitational forces holding the satellite together.

S

Satellite An object orbiting a planet; natural satellites are often referred to as “moons.”

Saturn electrostatic discharge. Radio bursts from Saturn with a periodicity of about 10 hours, 10 minutes; thought to be due to lightning activity in Saturn’s equatorial atmosphere.

Saturn kilometric radiation The major type of radio emission from Saturn, characterized by wavelengths in the kilometer range and a periodicity of about 10 hours, 39.4 minutes. The emission comes from regions in the auroral zones when these regions are near local noon.

Saturn local time. Solar time as measured for a local region on Saturn; the Sun is on the local meridian at local noon.



The Huygens Probe descends to Titan

Science payload The assemblies used for science data collection. For Cassini, this includes the science instruments on the Orbiter and the Huygens Probe.

Sequence A computer file of valid commands used to operate the spacecraft for a predetermined period of time.

Slurry A mixture of liquid and solid material, often of the same chemical composition.

Solar wind The highly ionized plasma streaming radially outward from the Sun at supersonic speeds. It consists largely of protons and electrons in nearly equal numbers with a small amount of ionized helium and ions of heavier elements. Embedded in it is the weak interplanetary magnetic field that originates at the Sun.

Spectroscopic analysis Determination of the composition and other characteristics of a surface or gas based on the relative brightnesses at a number of different colors.

Sputtering Erosion of a satellite’s surface as a result of bombardment by charged particles corotating with the magnetosphere.

Stratosphere. The layer of the atmosphere between the troposphere and the ionosphere; a stable layer in which heat is predominantly radiated (as opposed to conducted) away.

Subcarrier Modulation, applied to a carrier, which is itself modulated with information-carrying variations.

Subsequence A portion of a sequence that pertains to a single investigation or engineering subsystem.

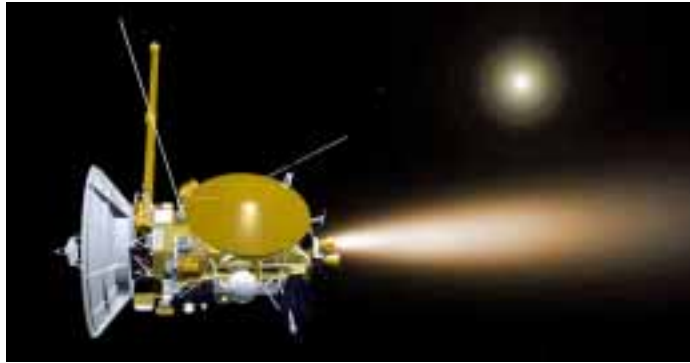
Synchronous rotation A dynamic state caused by tidal interactions in which the satellite always presents the same face toward the primary.

Synergism The combination of results from different science studies that produces a greater amount of information than the sum of the individual results.

T

Target The object that is observed at a given time by one or more spacecraft science instruments.

APPENDIX A



Deep space burn during cruise to Saturn

Targeted flyby A flyby that passes through a specified (usually very close) aimpoint at the time of closest approach.

Tectonics. A branch of geology dealing with surface structure, especially folding and faulting.

Telecommunications The process of commanding and receiving information from a remotely located spacecraft via radio signals.

Telemetry A stream of data bits radiated through space on electromagnetic waves or transmitted by wire or electronic pulses that represents the output of some sensor or scientific instrument.

Tenuous Very low density; difficult to detect (descriptive of E-ring particle distribution).

Tholin. Greek word meaning “muddy.” Describes the orange–brown products of laboratory experiments aimed at simulating the chemistry in Titan’s atmosphere.

Torus A collection of charged or neutral particles, shaped like a torus or doughnut, and generally associated with the orbital track of a satellite (like Titan).

Tracking data Data needed to track a spacecraft. These data are extracted from the properties of the radio signal received from the spacecraft. Examples of tracking data are Doppler and ranging data.

Trajectory The path of a body (i.e., a spacecraft) in space.

Transonic flow Flowing or moving near the local speed of sound.

Tropopause The boundary between the troposphere and the stratosphere.

Troposphere The atmospheric layer closest to the surface of Saturn or Titan in which convection is the dominant process for transporting heat; the layer in which “weather” takes place.

Turbulence A state of commotion or stormy agitation within an atmosphere.

U

Uplink. On the path from Earth to the spacecraft.

V

Viscosity The quality or property of a fluid or aggregate of particles that causes it to resist free flow.

Viscous relaxation. The slumping and subsequent disappearance of a feature due to gravitational forces acting on a material.

W

Wake. The track left by a body moving through a fluid.